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New records of epilachnine lady-beetles (Coleoptera, Coccinellidae, Coccinellinae) of Peru

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Abstract
The phytophagous coccinellids *Toxotoma guerini* Gordon 1975 and *Epilachna bistriguttata* Mulsant 1850 are species previously known only from Bolivia and Ecuador. Here, they are reported for the first time in Peru, in the regions of Cusco and Puno. The female of both species, unknown until now, is described and illustrated. In addition, an updated distribution map of both species is presented.

Key words
Epilachninae, *Toxotoma*, *Epilachna*, phytophagous, yungas, Neotropics, diversity.

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Introduction

Species of Epilachnini (Coleoptera, Coccinellidae, Coccinellinae) are strictly herbivorous and feed on soft tissue and fluids (Howard 1941). The greatest diversity of this tribe is found in tropical and subtropical regions, especially at the intersection of tropical forest and Andean ecosystems, and few species are known in temperate zones (Gordon 1975). Ślipiński and Tomaszewska (2010) and Seago et al. (2011) re-evaluated the subfamily Epilachninae, placing it as a tribe (Epilachnini) in the redefined subfamily Coccinellinae (Tomaszewska and Szawaryn 2016). Currently, the Epilachnini contains about 1000 species in 25 genera (Jadwiszczak and Węgrzynowicz 2003, Szawaryn and Tomaszewska 2013).

Gordon (1975) reviewed the Epilachnini (as Epilachninae), and proposed new taxonomic groups of species based on morphological similarities. The tribe was again revised by Tomaszewska and Szawaryn (2016), who redescribed the genera and highlighted *Epilachna* Chevrolat 1837 and *Toxotoma* Weise 1900 as the largest genera of Epilachnini. These genera are closely related, morphologically similar, and restricted to the New World (Szawaryn et al. 2015). Tomaszewska and Szawaryn (2016) also transferred to *Toxotoma* several species of *Epilachna*, which belong to 8 of the species groups described by Gordon (1975), and indicated that the remaining species of these groups would also belong to *Toxotoma*.

Toxotoma guerini Gordon, 1975 is known only from 2 Bolivian specimens deposited at the University of Cambridge, England (UCCC), in the Crotch collection. This species has distinctive male genitalia, unlike any known

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species of *Toxotoma*. The holotype has a single label with the data "Humboldti, Bolivia D." (Gordon 1975). González (2015) reported this species for the first time in Ecuador, in the Podocarpus National Park (–04.2833, -079.0000), province of Zamora Chinchipe, at an altitude of 2003 m, on the border with Peru.

Epilachna bistriguttata Mulsant 1850, whose female is unknown, was described based on a single male from the locality "Yungas, Haut-Perou" (Haut Perou = Bolivia) and its holotype is deposited in the Museum nationale d'Histoire Naturelle, Paris (MNHN). Gordon (1975) designated as lectotype the only specimen examined by him in the MNHN; however, we consider that this designation is mistaken, because in the original description Mulsant (1850: 719) did not mention the existence of more than one specimen and he gave only one value for each measure: "Long. 0^{m}, 0056 (2 1/2^{l}). - Larg. 0^{m}, 0045 (2^{l})". We believe that the specimen examined by Gordon is actually the holotype, because the information of the labels is the same as that of the specimen examined by Mulsant: "Patrie: Yungas, Haut-Pérou (Muséum de Paris, voyage de M. d'Orbigny)". The typical locality, "Yungas", refers to a geographical region of Bolivia located in the department of La Paz.

Methods

The species studied were found in a group of 1500 specimens of Coccinellidae collected between 1979 and 1997 from several provinces of the Cusco and Puno regions, in southern Peru. The identification of the material was made using the taxonomic keys, descriptions, and figures of the genital structures provided by Gordon (1975); the terminology used in the descriptions follows the same author.

The specimens were photographed with an AxioCam ICc5 camera, mounted on a Discovery V20 stereomicroscope; the genital structures were photographed with a Truechrome II camera installed on a Novel N-800m microscope. In both cases, the photographs were taken in a stacked series and combined using Helicon Focus and edited with Paint.net software to improve brightness, contrast, and correct imperfections.

The distribution map was created using ArcGIS 10. The geographic layers of Löwenberg-Neto (2014), based on Morrone's biogeographic classification (2014), were used. The collecting locations in Peru were georeferenced with data from the Instituto Nacional de Estadistica e Informatica (National Institute of Statistics, Peru) (http://sige.inei.gob.pe/test/atlas/).

The data of the labels are literally transcribed and missing or any relevant information is included in square brackets. The specimens studied are deposited in the Entomological Collection of the Universidad Nacional San Antonio Abad del Cusco (CEUC-UNSAAC), Cusco, Peru.

Results

Toxotoma guerini Gordon, 1975

Figs 1–6, 10, 11

Toxotoma guerini Gordon 1975: 36.

New country record. Peru, Puno department, Sandia province, –14.2483, –69.4311, 9 December 1997, coll. O. Ochoa M., 1 male (CEUC/COLCoc000101), 1 female (CEUC/COLCoc000102).

Diagnosis. *Toxotoma guerini* is distinguished from the other species by having the apical third of the middle lobe widened and narrowed abruptly at apex in a short and blunt projection (Fig. 4). This facilitates the separation of other species of similar habitus, such as *T. pilifera* (Weise, 1895).

Description. Female [n = 1]: length 9.2 mm, width 6.2 mm (Figs 10, 11), similar to the male (see Gordon 1975: 36). The posterior margin of the fifth (Fig. 1) and sixth (Fig. 3) abdominal sternite are without emargination. The female genital plaque is quadrangular with rounded edges, the inner margin is straight, while the outer margin is slightly curved and the posterior margin is straight. The stylus is visible (Fig. 2), and the posterior margin of the sixth abdominal tergite is deeply sinuous and the posterior margin of the tenth tergite is without emargination (Fig. 2).

Remarks. The specimens of *T. guerini* from Ecuador and Peru show slight variations in the elytral pattern, predominating the black color in Ecuadorian individuals. No greater differences are observed at the level of the male genitalia, which is very particular in the genus.

Geographical distribution. Bolivia, Ecuador (Podocarpus National Park), and Peru (Puno).

The 2 Peruvian specimens of *T. guerini* come from the town of Sandia (–14.2483, –69.4311), at an altitude of 2440 m, in the district and province of the same name, in the southern department of Puno.

Epilachna bistriguttata Mulsant 1850

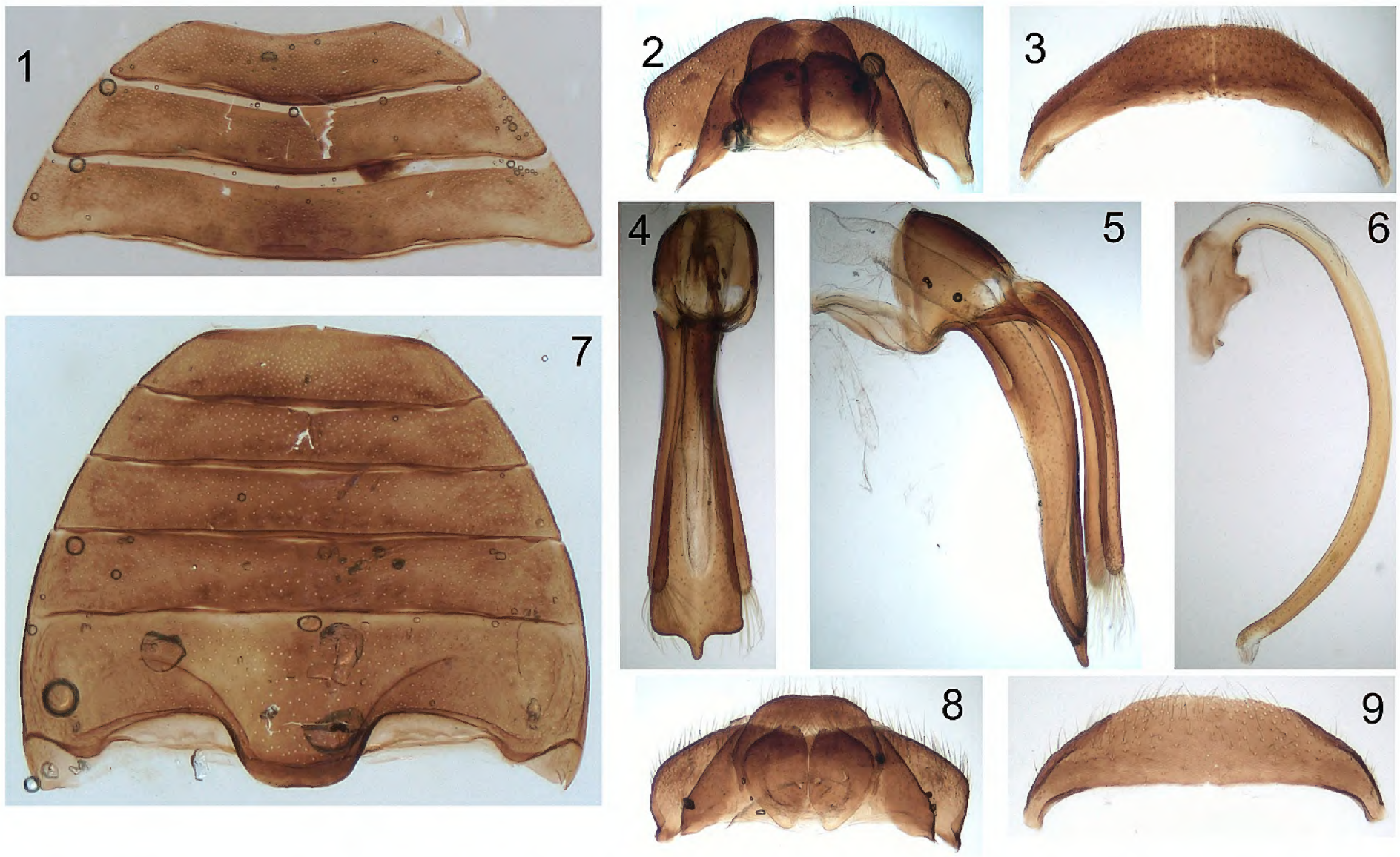
Figs 7–9, 12, 13

Epilachna bistriguttata Mulsant 1850: 719–720; Gordon 1975: 107.

New country record. Peru, Cusco department, Urubamba province, Machu Picchu, [–13.1620, –72.5455], 13 February 1979, 2040 m above sea level, 1 female, CEUC/ColCoc000120.

Diagnosis. The species is distinguished from the other species of the genus *Epilachna* by the elytral pattern with 3 spots in each elytron.

Description. Female [n = 1]: length 4.8 mm, width 3.8 mm (Figs 12, 13), similar to the male (see Gordon 1975: 107). The posterior margin of the fifth abdominal sternite is slightly curved and is without emargination (Fig. 7), and the posterior margin of the sixth abdominal sternite is straight (Fig. 9). The female genital plaque is subtriangu-



Figures 1–9. *Toxotoma guerini* and *Epilachna bistriguttata*. **1–6,** *T. guerini*: (**1**) abdomen, female; (**2**) female genital plate; (**3**) sixth abdominal sternite, female; (**4**) tegmen, dorsal view; (**5**) tegmen, lateral view; (**6**) sipho. **7–9,** *E. bistriguttata*: (**7**) abdomen, female; (**8**) female genital plate; (**9**) sixth abdominal sternite, female.

lar and presents the inner margin slightly sinuous, with the external margin curved, and the posterior margin straight with a visible stylus (Fig. 8). The posterior margin of the sixth tergite is broadly sinuous and the posterior margin of the tenth tergite is slightly emarginated (Fig. 8).

Remarks. The external appearance and shape of the body of *E. bistriguttata* are similar to *E. conjuncta* Gordon, 1975, also of Bolivia, which presents only 2 yellow elliptical spots. These 2 species show differences in the male genitalia: in *E. bistriguttata* the upper margin of the basal lobe presents 2 setae posterior to the middle, while in *E. conjuncta* there are no setae in the middle part of the basal lobe. The elytral design in *E. bistriguttata*, with 3 spots, is unique in the genus *Epilachna*. This feature, together with the male genitalia, allows easy identification of the species.

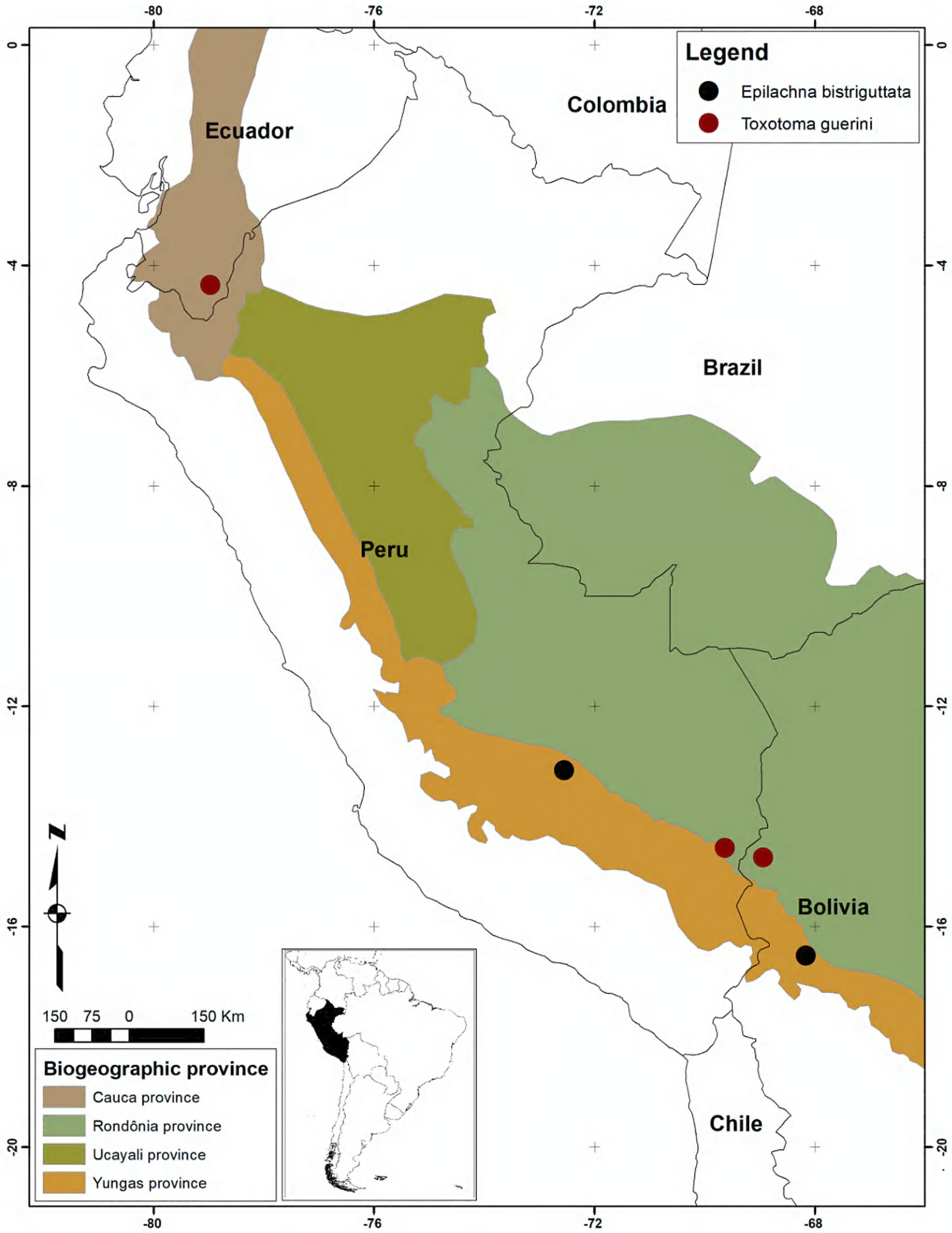
Geographical distribution. Bolivia and Peru.

The single Peruvian specimen of *Epilachna bistriguttata* comes from the department of Cusco, southeastern Peru. The specimen was collected in the town of Machu Picchu (–13.1717, –72.5455), in the district of the same name, province of Urubamba, at an altitude of 2040 m. The specimen is female, which was unknown by Mulsant (1850) or Gordon (1975) in the redescription of the species.

Discussion

The typical locality of *T. guerini* is located in the biogeographic province of Rondonia or Pantanal (Amazon

Figures 10–13. Females, *Toxotoma guerini* and *Epilachna bistriguttata*. **10, 11**, *T. guerini*: (**10**) dorsal habitus; (**11**) lateral view. **12, 13,** *E. bistriguttata*: (**12**) dorsal habitus; (**13**) lateral view.



14. Currently known distribution of *Toxotoma guerini* and *Epilachna bistriguttata*.

subregion, Neotropical region), in the department of La Paz. The biogeographic province of Rondonia is located in southern and central Brazil, northwestern Bolivia and northern Paraguay. This province consists of a mosaic of flooded grasslands, savannas, gallery forests and dry forests, which are flooded during the rainy season (Morrone 2001). The record of this species in Ecuador is located in the Podocarpus National Park, near the border with Peru, in the biogeographic province of Cauca (Caribbean subregion of the Neotropical region) that covers the western territories of Colombia and Ecuador (Morrone 2001).

The localities of *E. bistriguttata* in Peru and Bolivia are located in the biogeographic province of Yungas (Amazon subregion, Neotropical region), which covers the eastern slopes of the Andes, between 300 and 3500 m altitude, from the north of Peru to the northwest of

Argentina (Morrone 2001). The Peruvian Yungas comprises dense cloud forests with a very humid climate that covers the upper parts of the drainage basins of the Tambopata, Inambari, Kosñipata, Urubamba and Apurimac rivers. These basins have several types of vegetation and, at a faunistic level, the high parts of the Yungas resemble Andean diversity, and at lower elevations, the Amazonian influence becomes evident (Brack 1986).

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Authors' Contributions

AABN: manuscript writing, processing of genital structures, photographs, and editing; AJOR: manuscript writing, photographs, editing, and map preparation; AET: processing of genital structures, photographs, and editing; ELMM: processing of genital structures, photographs, and editing; EYL: manuscript writing.

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